DRAFT ANNOTATED CHECKLIST OF THE AMPHIBIANS AND REPTILES OF THE SULPHUR SPRINGS VALLEY, COCHISE COUNTY, ARIZONA

Philip C. Rosen[1], Shawn S. Sartorius[1], Cecil R. Schwalbe[2], Peter A. Holm[1], and Charles H. Lowe[1]

[1]Department of Ecology and Evolutionary Biology
University of Arizona, Tucson, AZ 85721

and

[2]National Biological Service, Cooperative Park Studies Unit
School of Renewable Natural Resources, University of Arizona, Tucson, AZ 85721

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EXECUTIVE SUMMARY

This report details herpetological conservation and ecology work in the Sulphur Springs Valley, Cochise County, Arizona, primarily during 1993-5. We also present supporting information from this and other southeastern Arizona grassland valleys from the mid-1970's through the early 1990's. In addition, we conducted a search of museum records for the region, and have integrated the resultant information into an annotated checklist, with conservation recommendations and discussion of community structure and biogeography.

The known herpetofauna of the Sulphur Springs Valley totals 61 species (11 frogs and toads, 1 salamander, 3 turtles, 21 lizards, and 25 snakes; Table 1), of which we observed 51 during our field work during 1993-1995. Geographically, the valley is one of the largest in Arizona, has little natural perennial surface water, and broad level plains on the valley floor that are still primarily grassland. This combination of landscape features has resulted in a speciose herpetofauna with a strong representation of grassland species characteristic of the Great Plains, especially the southern Great Plains.

Based on distributional data, six ecological categories were identified; with the number of species represented in the valley: (1) the grassland element restricted to the valley floor, about 10 species; (2) grassland species on the valley floor and on grassy bajadas, 8; (3) species in the narrow band of Chihuahuan desertscrub on the upper bajada, 8; (4A) generalists moderately abundant in most valley habitat types, 3; (4B) uncommon Sonoran Desert species, 10; (5A) Madrean montane species uncommon or local high on the bajada, 4; (5B) riparian species in the valley at riparian and xeroriparian sites peripheral to the valley bottom, 7; (6) perennial water species that occur wherever there is suitable water, 4.

Only in the San Bernardino Valley can we find a rival for the prime grassland herpetofauna in Arizona, and certain important wetland species are apparently absent there. The broad valley floor of the Sulphur Springs has long supported large populations of many frogs and toads, as well as populations of mud turtles of two species, and box turtles. For both valleys, the herpetofaunal assemblage is derived from Great Plains grassland (the Kansan biogeographic province), Chihuahuan desertscrub and grassland, and Sonoran desertscrub and thornscrub; in addition, Madrean woodland species enter the valleys' bajadas. It is the dominant plains grassland forms, supplemented by Sonoran and Chihuahuan desert forms, that compose the core of the desert grassland herpetofauna, so well expressed in the Sulphur Springs and San Bernardino Valleys, the Sonoita Grasslands, and the middle San Pedro Valley.

The Sulphur Springs Valley has long been utilized for farming and ranching, and it now faces potential suburbanization that could irretrievably close its open spaces and eliminate the potential for native ecosystem restoration. An important objective of our study is to provide information for, and foster interest in, natural habitat and species conservation, especially in the Sulphur Springs Valley. Recommendations for individual species, for possible land acquisitions, and for landholder cooperation or easement activities are presented in the document and summarized here.

The species of greatest concern that are importantly present in the Sulphur Springs Valley, in order of priority for attention, (conservation problem(s) in parentheses), are [1] plains leopard frog *Rana blairi* (localized distribution; effects of introduced species; habitat modification and destruction), [2] little striped whiptail *Cnemidophorus inornatus arizonae*, the Arizona whiptail (highly localized endemic subspecies; housing and agricultural encroachment; possibly, succession away from grassland), [3] yellow mud turtle

Kinosternon f. flavescens (unexplained rarity; habitat destruction; probable other unknown), [4] massasauga *Sistrurus catenatus* (rarity; major historical range reductions; cause(s) unknown, with possible effects of heavy grazing), [5] western box turtle *Terrapene ornata* (road mortality; possibility for commercial collection), [6] green rat snake *Elaphe triaspis* (rarity; potential for illegal collection), [7] western hognose snake *Heterodon nasicus* (at range margin; road mortality), [8] Chihuahuan hook-nosed snake *Gyalopion canum* (unexplained, apparent rarity in Arizona), [9] ground snake *Sonora semiannulata* (potential extinction of unique demes by collecting or trampling by cattle), [10] plains black-headed snake *Tantilla nigriceps* (apparent rarity; possible trampling of microhabitat), [11] Texas horned lizard *Phrynosoma cornutum* [at western range margin]. Further discussion of each species is presented below; the first three taxa are of substantial concern at this time, as they are disjunct from the rest of their ranges, and at their Arizona ecological center, in the Sulphur Springs Valley.

The recommendations, described in greater detail in the text, are as follows.

(I) For the plains leopard frog:

(1) Develop a landowner-easement mechanism to maintain or create suitable habitat conditions.

(2) Acquire certain suitable habitat areas as part of a Sulphur Springs Valley conservation and recreation area. Both options may be pursued. The area of primary interest is central Whitewater Draw.

(3) The plains leopard frog *Rana blairi* should be considered endangered in the State.

(II) For the little striped whiptail:

(1) The Arizona whiptail, *Cnemidophorus inornatus arizonae* Wright and Lowe, should be listed as threatened by the State.

(2) More in-depth distributional and ecological study of the taxon.

(III) For the yellow mud turtle:

(1) State listing as threatened for the Cochise and, newly reported herein, Graham County populations of the nominate subspecies *Kinosternon flavescens flavescens*.

(2) More in-depth distributional and ecological studies.

(3) Encourage habitat conservation through purchase, as for (1) the plains leopard frog (above).

(IV) For the massasauga:

(1) Further survey by road-driving.

(2) Research directed at identifying cause(s) of decline.

(3) Purchase of parkland in remaining grassland habitat, to support this and many other grassland species. The primary area for consideration is between Davis Road (McNeal) and Glenn Road (4 miles north of Rte. 80), to the east of, or including land on both sides of, State Route 191 (US 666). The area is proximal to central Whitewater Draw, and could be encompassed within a unified lower valley conservation area.

(V) For the western box turtle, green rat snake, western hognose snake, Chihuahuan hook-nosed snake, and plains black-headed snake:

(1) Retain on the Heritage Program list of Sensitive Species, and encourage or support further study.

(VI) For the ground snake:

(1) The ground snake, *Sonoran semiannulata* should be added to the Heritage Program list of

Sensitive Species, for southern Arizona. The degree of discontinuity of its distribution should be evaluated statewide.

The herpetofauna of the Sulphur Springs Valley today remains strong, with the exceptions of the native perennial water species and the massasauga. Many grassland birds and mammals remain similarly abundant and readily observed. The area is threatened by increasing human population pressure. We hope the results of this study assist a move to save substantial areas of the valley, and ultimately the valley as an ecosystem, for native species and for our enjoyment of them.

INTRODUCTION

Environment.

The grasslands of southeastern Arizona are a semi-arid extension of the plains grassland, heavily influenced by both Sonoran and Chihuahuan desert grassland. Many of the plant species, especially tobosa grass and some of the grama grasses, are desert grassland species with associations to the south in the Chihuahuan region (Martin, 1963), and apparently for this reason, the biome is often termed the desert grassland (e.g., McClaran and Van Devender, 1995). Morafka (1974) found that the region is a transitional or ecotonal "filter barrier" uniting Sonoran, Chihuahuan, and Kansan biogeographic provinces. He also showed that these three provinces are closely allied herpetofaunally, with the strongest ties between Chihuahuan and Kansan. Although the region is famous for the sky island mountains with Mexican biogeographic affinities, the grassland or desert grassland is perhaps as frequently in contact at its upper edge with Chihuahuan desertscrub as with Madrean oak woodland. In the western and northern edges of the region, grassland at its lower edge contacts Sonoran desertscrub.

Grasslands are usually supported on broad valley floor flats (often tobosa [*Hilaria mutica*]-dominated) and gentle bajadas (which may have a diversity of native gramas (*Bouteloua* spp.) and other grasses). Many areas have seen replacement of native by introduced grasses, especially by Lehmann's lovegrass (*Eragrostis lehmanniana*). Floodplains often support extensive stands of big sacaton (*Sporobolis airoides*), and saline flats may support alkali sacaton (*S. wrightii*) and saltgrass (*Distichlis stricta*). Shrub invasion into grass-dominated habitat is a prominent feature of much of southeastern Arizona that has been much discussed and debated (Hastings and Turner, 1965; Humphrey, 1987; Bahre, 1991; and many others). The invading species are such grazing-resistant shrubs as burrow-weed (*Isocoma tenuisecta*), mesquite (*Prosopis glandulosa*), snakeweed (*Gutierrezia sarothrae*), and soaptree yucca (*Yucca elata*), probably in that order of abundance. Suppression of fire has undoubtedly added to grazing-induced replacement of palatable by less palatable or unpalatable plants, and relatively wet weather, especially in winter, may be contributory. The significance, or lack of significance, of any of these factors on any specific declining taxon is unclear.

Natural perennial waters in the southeastern Arizona grasslands are primarily valley bottom springs; montane waters sink into the substratum prior to contacting the grassland for most of the year. Natural springs are present in every valley, although they are historically small or insignificant in the Sulphur Springs Valley, and today, with the destruction of the clay layer and pumpdown of groundwater in the San Simon Valley, natural springs that once supported Gila chubs (*Gila intermedia*; Sublette et al., 1990) and undoubtedly leopard frogs there are gone. The San Bernardino, San Pedro, Santa Cruz, Babacomari, and formerly the San Simon, rivers rise on grassland floors, as do Cienega and Arivaca creeks. Whitewater Draw in the Sulphur Springs Valley rose in grassland as a partly permanent stream (Hendrickson and Minckley, 1985), probably drying extensively during less rainy eras (e.g., Gray, 1963). Like the Sulphur Springs Valley, the Avra-Altar Valley probably had primarily small or ephemeral springs in the pre-Caucasian era. Today, all the major valley spring systems are modified by impoundments as well as down-cutting of streams into formerly marshy cienegas. Cattle-watering stock ponds dot the landscape, and many sites are supplied with wind-powered wells, maintaining unnaturally constant water levels. Today, there is more water on the landscape than originally, but far less natural wetland habitat.

History of the desert grassland in particular, and to some extent the grassland biome in general, is not well understood. Grassland is relatively recent in origin, perhaps in mid-Cenozoic times (Van

Devender, 1995). In southeastern Arizona, desert grassland has been present for perhaps 8,000 or 9,000 years, since the last pluvial (Martin, 1963) when woodland and forest species descended at least to Willcox Playa. The location of the grassland fauna during Pleistocene glacial (pluvial) episodes is not known.

Faunal Patterns.

Terrestrial animals of the southeastern Arizona grasslands are a mix of species from the three contributory biomes--the Chihuahuan and Sonoran deserts (with their associated thornscrub and grassland) and the Great Plains grassland, which intersect in the area at an east-west-south nexus (Lowe and Zweifel, 1992). Of particular interest are large areas that still support characteristic grassland species (D. Brown, 1982; L. Brown, 1985) such as the spotted ground squirrel (*Spermophilus spilosoma*), badger (*Taxidea taxus*), pronghorn (*Antilocapra americana*), horned lark (*Erimophilia alpestris*), loggerhead shrike (*Lanius ludovicianus*), Swainson's hawk (*Buteo swainsoni*), and burrowing owl (*Athene cunicularia*) among the endotherms, and the area once supported the black-tailed prairie dog (*Cynomys ludovicianus*; see Allen, 1895) and possibly even the black-footed ferret (*Mustela nigripes*).

Amphibians and reptiles of the grassland biome are similarly strongly represented in southeastern Arizona. These include the tiger salamander (*Ambystoma tigrinum*, locally native in the San Raphael Valley as *A. t. stebbinsi*, but elsewhere present as introduced populations of the plains form, *A. t. mavortium*), plains leopard frog (*Rana blairi*), plains spadefoot (*Scaphiopus bombifrons*), Great Plains narrow-mouthed toad (*Gastrophryne olivacea*), Great Plains toad (*Bufo cognatus*, also widespread and abundant throughout the northern Sonoran desert), yellow mud turtle (*Kinosternon flavescens*), western box turtle (*Terrapene ornata*), Great Plains skink (*Eumeces obsoletus*), Texas horned lizard (*Phrynosoma cornutum*, lesser earless lizard (*Holbrookia maculata*), Texas blind snake (*Leptotyphlops dulcis*), plains black-headed snake (*Tantilla nigriceps*), ground snake (*Sonora semiannulata*), checkered garter snake (*Thamnophis marcianus*), western hognose snake (*Heterodon nasicus*), and massasauga (*Sistrurus catenatus*). This long list clearly allies the southeastern Arizona grassland first and foremost with the Great Plains ("Kansan") biogeographic province.

There is a strong representation of desert-included generalist species that are found in two or more major regional biomes. Among the dominants of the grasslands are the coachwhip (*Masticophis flagellum*), western patch-nosed snake (*Salvadora hexalepis*), gopher snake (bullsnake, *Pituophis melanoleucus*), common kingsnake (*Lampropeltis getula*), Mojave rattlesnake (*Crotalus scutulatus*), leopard lizard (*Gambelia wislizenii*), tree lizard (*Urosaurus ornatus*), Couch's and southern spadefoots (*Scaphiopus couchii, S. multiplicatus*), and Woodhouse's toad (*Bufo woodhousei*). The longnosed snake (*Rhinocheilus lecontei*) and western diamondback rattlesnake (*Crotalus atrox*) are primarily desert species that are often represented in the grassland. Although these species are few, they are very important numerically and ecologically in the assemblage, and are conspicuous.

Primarily Chihuahuan forms include the green toad (*Bufo debilis*), round-tailed horned lizard (*Phrynosoma modestum*), greater earless lizard (in desertscrub, *Cophosaurus texanus*), little striped whiptail (*Cnemidophorus inornatus*), and the Chihuahuan hooknosed snake (*Gyalopion canum*). Forms with Sonoran (and partially, Chihuahuan, indicated with an *) biogeographic affinities occur in the region on the lower grassland edge in Chihuahuan desertscrub, such as the desert spiny lizard (*Sceloporus magister**), side-blotched lizard (*Uta stansburiana**), zebra-tailed lizard (*Callisaurus draconoides*), regal horned lizard (*Phrynosoma solare*), western banded gecko (*Coleonyx variegatus*), western whiptail (*Cnemidophorus tigris*), Gila monster (*Heloderma suspectum*), desert tortoise (*Gopherus agassizii*), and

Sonoran Desert toad (*Bufo alvarius*), or along the upper (also Chihuahuan desertscrub) grassland edge, such as Clark spiny lizard (*S. clarkii*), southwestern black-headed snake (*Tantilla hobartsmithi*), and western coralsnake (*Micruroides euryxanthus*); some of these occur on both grassland edges.

There is also a significant presence of Madrean woodland species, which penetrate far into the grassland primarily as riparian species, such as the Madrean alligator lizard (*Gerrhonotus kingii*), short-horned lizard (*Phrynosoma douglassii*), Sonoran whipsnake (*Masticophis bilineatus*), Mexican garter snake (*Thamnophis eques*), and Chiricahua leopard frog (*Rana chiricahuensis*).

The desert grassland has few endemic species, as may be expected for a relatively recently developed biotype (Van Devender, 1995) and one that is derived from three more strongly defined biogeographic provinces. The only endemic species is a unisexual (clonal) lizard of hybrid origin, the desert grassland whiptail (*Cnemidophorus uniparens*), although one of its parental species, the little striped whiptail, is represented as a recently described (Wright and Lowe, 1993) endemic subspecies (*C. inornatus arizonae* [Van Denburgh] in the area. The green toad (*Bufo debilis*), the round-tailed horned lizard (*Phrynosoma modestum*), and Chihuahuan hook-nosed snake (*Gyalopion canum*) are characteristic of desert grassland and Chihuahuan desertscrub (Lowe, 1964). The following subspecies are endemic to or characteristic of the desert grassland and Chihuahuan desert grassland: southern prairie lizard (*Sceloporus undulatus consobrinus*), desert box turtle (*Terrapene ornata luteola*), lined coachwhip (*Masticophis flagellum lineatulus*), desert kingsnake (*Lampropeltis getula splendida*), Mexican hognose snake (*Heterodon nasicus kennerlyi*), and desert grassland massasauga (*Sistrurus catenatus edwardsi*), based on our observations, Lowe (1964), and Stebbins (1985).

Sulphur Springs Valley.

The Sulphur Springs Valley is the region from about Douglas on the south to Fort Grant or Bonita on the north. More specifically, it includes the bajadas and valley floor areas (not including rock slopes) in the following drainage basin areas: all of the Willcox Playa closed basin, the Aravaipa Creek basin north to the point it enters a constrained canyon (above Klondyke), and the Whitewater Draw-Río de Agua Prieta basin south of the border about 10 miles, where it enters a constrained canyon. The valley thus lies between the Pinaleño and Galiuro Mountains on the north, the Chiricahua and Dos Cabezas Mountains on the east and the Dragoon and Mule Mountains to the west; it is bounded on the north by the Santa Teresa Mountains, and on the south by the Pedrogosa and Perilla Mountains and the Sierras Anibacichi and Ceniza and Cerro Cabullona. The valley is about 120 mi (190 km) long and generally 15-25 mi (25-40 km) wide. For practical purposes, we have terminated our consideration at the international border. We have selected this as an area of focus because of its rich grassland herpetofauna, and because much of it is threatened by semi-rural suburban sprawl.

The valley has flats occupying a wide area of the floor. The northern quarter of the valley, north of Willcox, is largely devoted to row crops, and has relatively little unmodified or semi-natural habitat. Willcox, on the saline flats north and west of Willcox Playa (pluvial Lake Cochise), is surrounded by well-developed alkali grasslands, with stabilized dunes and a sand sage area to the east and southeast, and orchard and row crop agriculture to the south-southeast. To the west and southwest are dense, medium-to-tall mesquite thickets, and the bajadas of the Dragoon Mountains, further west, are occupied by mesquite-yucca grassland. The Sulphur and Squaretop Hills dominate the center of the valley, where shrubs and introduced grasses occupy most areas, including the surrounding flats. This area is margined to the south by another row-crop dominated zone that narrows to the south into the west and center of the valley.

South of and around this agriculture is a tobosa-dominated grassland that is variably and weakly invaded by mesquite, yucca, and burrow weed. To the south of the tobosa, around Douglas, the grassland is largely converted to a complex mixed scrub of mesquite, yucca, prickly pear, and other semi-desert shrubs. Both east and west, the bajadas adjoining the grassland are dominated by Chihuahuan desertscrub with creosote, mesquite, (Chihuahuan) whitethorn acacia (*Acacia neovernicosa*), and other characteristic shrubs (mariola [*Parthenium incanum*], tarbush [*Flourensia cernua*]), which largely surrounds the Chiricahuas and which extends through to Tombstone where it is best developed. Martin (1963) presents an excellent description of vegetation and landform in the southern part of the valley.

The Sulphur Springs is the largest valley in Arizona (excluding the larger, through-flowing river valleys), and it might be the best anuran (frog and toad) valley in the region. It has two native plus one introduced ranid frog species, including a major peripherally isolated population of the plains leopard frog. In wetter times, the Chiricahua leopard frog has historically occupied many sites in the valley. There are also three sympatric species of spadefoot toads that can be found breeding together in a single pond, and at least three species of true toads. The true toads are diverse and abundant, and the attractive green toad is found in consistently large numbers. The abundance and diversity of anurans also makes the valley an outstanding locality for the western hognose snake and checkered garter snake, both of which are in abundance in direct association with anuran breeding populations. There is an excellent representation of grassland forms of reptiles and amphibians in the core of Sulphur Springs Valley, and the clear patterns of habitat partitioning within the fauna will be a focus of this annotated checklist.

CHECKLIST OF THE AMPHIBIANS AND REPTILES OF THE SULPHUR SPRINGS VALLEY, COCHISE COUNTY, ARIZONA

This draft annotated checklist for the herpetology of the Sulphur Springs Valley, Cochise County, Arizona, is still a work in progress. The primary focuses of this advanced draft are (1) to present a clear and complete overview of this grassland fauna, (2) to outline the community structure of the fauna in relationship to habitat, (3) to identify species of special interest that may require conservation or management, and (4) to identify habitat especially important for grassland conservation and provide management recommendations for the habitat and specific species in it.

We have worked extensively in the valley for three years, 1993-1995, under the original stimulus of Arizona Game and Fish Department Heritage Funding in 1993, and with continuing support from San Bernardino National Wildlife Refuge and the USDA Forest Service. In addition, we have included our data from previous work in the valley, principally during the late 1980's, and also in the mid-1970's. This field work produced 675 observations (193 for anurans, 7 for salamanders, 45 for turtles, 106 for lizards, 324 for snakes), with each observation consisting of an independent locality record. Finally, we have made inquiries of many museums, and incorporated the resultant information for 2551 specimen records (687 anurans, 0 salamanders, 61 turtles, 1300 lizards, 503 snakes) into the following description of the herpetofauna. Note the rough similarity in the number of snakes and turtles that we observed and those recorded from museums, and the differences for other taxa. The differences reflect the simultaneous collection of large numbers of individual lizards and anurans in what would constitute, in our field work enumeration here, a single observation.

The currently known species total for the Sulphur Springs Valley includes 61 species (11 frogs and toads, 1 salamander, 3 turtles, 21 lizards, and 25 snakes; Table 1), of which we observed 51 in our 1990's field work. The totals will undoubtedly be expanded as more data become available: there is much more to be learned. Many readers will find that they have information in addition to, or possibly in contradiction with, ours as presented. We would appreciate any assistance in the ongoing effort to develop a clear view of this herpetofauna and biome in general, and to develop plans for saving as much of it as possible.

Table 1. Amphibians and reptiles from Sulphur Springs Valley, Cochise County, Arizona. Dangerously venomous species are indicated by an asterisk (*). Habitat categories are described in text.

	Habitat Category
CLASS AMPHIBIA--Amphibians	
ORDER ANURA--Frogs and Toads	
FAMILY BUFONIDAE--Toads	
Sonoran Desert (Colorado River) Toad--*Bufo alvarius*	4B
Great Plains Toad--*Bufo cognatus*	2
Green Toad--*Bufo debilis*	2
Red-spotted Toad--*Bufo punctatus*	3
Woodhouse Toad--*Bufo woodhousei*	2/1?
FAMILY PELOBATIDAE--Spadefoot Toads	
Plains Spadefoot--*Scaphiopus bombifrons*	1
Couch's Spadefoot--*Scaphiopus couchii*	2/4A
Southern Spadefoot--*Scaphiopus multiplicatus*	2/4A/5A
FAMILY RANIDAE--True Frogs	
Plains Leopard Frog--*Rana blairi*	1
Chiricahua Leopard Frog--*Rana chiricahuensis*	6
Bullfrog--*Rana catesbeiana*	6
ORDER CAUDATA--Salamanders	
FAMILY AMBYSTOMATIDAE--Mole Salamanders	
Tiger Salamander--*Ambystoma tigrinum*	5B/6

CLASS REPTILIA--Reptiles	
ORDER TESTUDINES--Turtles	
FAMILY EMYDIDAE--Pond Turtles	
Western Box Turtle--*Terrapene ornata*	2
FAMILY KINOSTERNIDAE--Mud and Musk Turtles	
Yellow Mud Turtle--*Kinosternon flavescens*	1
Sonoran Mud Turtle--*Kinosternon sonoriense*	6
ORDER SQUAMATA--Lizards and Snakes	
SUBORDER SAURIA (LACERTILIA)--Lizards	
FAMILY ANGUIDAE--Anguids	
Madrean Alligator Lizard--*Gerrhonotus (Elgaria) kingii*	5A
FAMILY GEKKONIDAE--Geckos	
Western Banded Gecko--*Coleonyx variegatus*	4B
FAMILY HELODERMATIDAE--Beaded Lizards	
*Gila Monster--*Heloderma suspectum*	4B
FAMILY IGUANIDAE--Iguanids	
Lesser Earless Lizard--*Holbrookia maculata*	2/1?
Greater Earless Lizard--*Cophosaurus texanus*	3
Common Collared Lizard--*Crotaphytus collaris*	3
Long-nosed Leopard Lizard--*Gambelia wislizenii*	4B
Texas Horned Lizard--*Phrynosoma cornutum*	2/1?+3
Short-horned Lizard--*Phrynosoma douglassii*	5A
Round-tailed Horned Lizard--*Phrynosoma modestum*	3
Regal Horned Lizard--*Phrynosoma solare*	4B

Clark Spiny Lizard--*Sceloporus clarkii*	3/5A
Desert Spiny Lizard--*Sceloporus magister*	4B
Eastern Fence Lizard--*Sceloporus undulatus*	2
Tree Lizard--*Urosaurus ornatus*	4A
Side-blotched Lizard--*Uta stansburiana*	4B
FAMILY SCINCIDAE--Skinks	
Great Plains Skink--*Eumeces obsoletus*	5B
FAMILY TEIIDAE--Teiids	
Little Striped Whiptail--*Cnemidophorus inornatus*	1
"Sonoran Spotted" Whiptail--*Cnemidophorus sonorae* sensu lato	5A
Western Whiptail--*Cnemidophorus tigris*	4B
Desert Grassland Whiptail--*Cnemidophorus uniparens*	2
SUBORDER SERPENTES (OPHIDIA)--Snakes	
FAMILY COLUBRIDAE-Colubrids	
Glossy Snake--*Arizona elegans*	4B
Ringneck Snake--*Diadophis punctatus*	5B
Green Rat Snake--*Elaphe (Senticolis) triaspis*	5B
Chihuahuan Hook-nosed Snake--*Gyalopion canum*	3?
Western Hognose Snake--*Heterodon nasicus*	1/2?
Night Snake--*Hypsiglena torquata*	4B
Common King Snake--*Lampropeltis getula*	2
Sonoran Whipsnake--*Masticophis bilineatus*	5B
Coachwhip--*Masticophis flagellum*	4A
Gopher Snake (Bullsnake)--*Pituophis melanoleucus*	4A
Long-nosed Snake--*Rhinocheilus lecontei*	4A

Mountain Patch-nosed Snake--*Salvadora grahamiae*	5A
Western Patch-nosed Snake--*Salvadora hexalepis*	3/4B
Ground Snake--*Sonora semiannulata*	1/2?,+3
Southwestern Black-headed Snake--*Tantilla hobartsmithi*	4B
Plains Black-headed Snake--*Tantilla nigriceps*	2
Checkered Garter Snake--*Thamnophis marcianus*	1
Black-necked Garter Snake--*Thamnophis cyrtopsis*	5B
Lyre Snake--*Trimorphodon biscutatus*	5B
FAMILY LEPTOTYPHLOPIDAE--Slender Blind Snakes	
Texas Blind Snake--*Leptotyphlops dulcis*	1/?2
FAMILY ELAPIDAE--Coral Snakes	
*Western Coral Snake--*Micruroides euryxanthus*	3
FAMILY VIPERIDAE--Vipers	
*Western Diamondback Rattlesnake--*Crotalus atrox*	3
*Black-tailed Rattlesnake--*Crotalus molossus*	5B
*Mojave Rattlesnake-*Crotalus scutulatus*	2
*Massasauga--*Sistrurus catenatus*	1/2?

ANNOTATED CHECKLIST:

Amphibians

Sonoran Desert Toad--*Bufo alvarius*. 2 observations, 4 museum specimen records. We have single observations of this large toad in the Sulphur Springs Valley area, near Kovacs Lakes at the south end of Coffman Rd, and on lower Leslie Canyon Rd. We also have a museum record from near Cochise, along the west side of Willcox Playa. It is abundant in the Chihuahuan desertscrub-alkali sacaton in the Malpai lands of the lower San Bernardino Valley, in Guadalupe Canyon, and as far north as Mormon Tank along Black Draw, so it may also be regularly present in some desert areas around the Sulphur Springs Valley floor.

Great Plains Toad--*Bufo cognatus*. 33 observations, 76 museum specimen records. This toad is abundant in most or all areas and habitats in the Sulphur Springs Valley, especially so on the bajada east and north of Sunizona. Along with *Scaphiopus couchii* and *S. multiplicatus*, it is the most widely and abundantly observed amphibian in the valley.

Green Toad--*Bufo debilis*. 20 observations, 167 museum specimen records. The green toad was found breeding in abundance in 1989 and 1993 in shallow grassland temporary ponds in the south-central region of the valley, and in lower abundance in the surrounding desert edge at slightly higher elevations. For example, in 1989, we found it in abundance with *B. cognatus* at 0.2 mi N of Double Adobe (Aug. 5; repeated on July 10, 1993). On July 10 and 11, 1993, at 2.58 mi S of Davis Road on Rte. 191, we estimated 100-300 breeding *B. debilis*, 24-48 *B. cognatus*, 3-4 *S. multiplicatus*, and 2 *S. couchii* (1 DOR [dead on road], one on land), and on 11 July a few dozen *B. debilis* alone were found E of Rte. 191 at 4.17 mi S of Davis Rd. A mixed chorus of these same species was also observed on that night at 8.9 mi (rd) S of Davis Road on Rte. 191. The species was observed and heard at other localities on July 10-11, along lower Leslie Canyon Road and in Chihuahuan desertscrub-tobosa ecotone at 3.2 mi NW Rucker Canyon junction on Davis Road at Leslie Creek Wash, but in smaller numbers. We also observed a *B. debilis* under a rock at the hill on Davis Rd, 12 mi W of Rte. 191, on June 16, 1993. We also found them abundant in Whitlock Valley south of Hackberry Ranch on August 19, 1994. Thus, the species is in a variety of habitats over a wide area, and at moderately high abundances, in this region.

Red-spotted Toad--*Bufo punctatus*. We did not find this species in the valley, but it is known from Geronimo Trail less than 1/2 mile east of the divide to the San Bernardino Valley. We have four museum records for the Fort Bowie area, and for the high desert at Portal. Our nearest observation is for Dripping Springs Tank in the Whitlock Mountains. This species undoubtedly occurs in the Sulphur Springs Valley at its margins. The local ecological distribution of this species resembles that of the greater earless lizard.

Woodhouse Toad--*Bufo woodhousei*. 9 observations, 15 museum specimen records. This species is not common in the Sulphur Springs Valley, but of consistent occurrence. We have six records for the valley floor from Kansas Settlement south to a local concentration at lower-central Whitewater Draw, and a single record for Turkey Creek Wash riparian high on the bajada east of Sunizona.

Plains Spadefoot--*Scaphiopus bombifrons*. 10 observations, 206 museum specimen records. We found this grassland-associated species in some abundance in the northern sections of the valley, south to Elfrida but not to McNeal. The reason for this mapped (Stebbins, 1985) and stable range boundary is

not clear. It was a prominent species in July 1993 just north of Elfrida and north along Rte. 191 (666) to Turkey Creek Ridge at Sunizona, but less abundant on the bajada east of Sunizona. Sites we located it in abundance turned out to be identical to those vouchered by Lowe and his associates for the 1950's and 1960's. Large choruses dominated by *S. bombifrons* were heard on 12 July 1993 on Rte. 191 2.97 mi S of Sunizona junction (ca. 200 *S. bombifrons*, 36 *S. multiplicatus*, 6 *S. couchii*) and at ca. 1/2 mi+ S of Rte. 181, 4.68 mi E of Rte. 191 near Sunizona junction (huge number of *S. bombifrons* with many calling *Bufo cognatus*); the region along the roads between these sites was generally dominated by *S. bombifrons*, especially at 1-2 mi S of Sunizona junction. Further east, up the bajada from 4.68 mi E of 191, no *S. bombifrons* were heard or seen, and a handful of *B. cognatus*, *S. couchii*, and *S. multiplicatus* were seen on Rte. 181 W and S of Rte. 186 (junction to Chiricahua National Monument).

Couch's Spadefoot--*Scaphiopus couchii*. 68 observations, 43 museum specimen records. This widespread Sonoran Desert species was often abundant in lowland areas throughout much of the valley and elsewhere in Cochise County. In the area of overlap with the other two spadefoot species it appeared to be by far the least abundant of the three congeners. In the desertified vegetation north of Douglas on Leslie Canyon Road, it was the dominant species, and we found it increasingly abundant as we moved south on Central Highway from Elfrida in 1989 and 1993. For example, on July 9, 1993, we observed over 150 breeding *S. couchii* with about 12 *S. multiplicatus* in silty culvert pools along the road. In the tobosa grass, by contrast, in semi-natural flood pools, enhanced by levees, 1/3 mi W of Rte. 191 at 2.17 mi S of Lee Rd, we estimated 200-400 *S. multiplicatus*, 50-150 *Bufo debilis*, and only 10-20 *S. couchii* on 11 July 1993.

Southern Spadefoot--*Scaphiopus multiplicatus*. 35 observations, 63 museum specimen records. This spadefoot was found in abundance over a wide area of the valley. In Elfrida along the highway and on main side street ditches and puddles, on 12 July 1993, we estimated 300 *S. multiplicatus*, 150 *S. couchii*, and 3 *S. bombifrons* in breeding aggregations, and we saw a single *Bufo cognatus*; and at the N end of Elfrida there were many of the first two, 1 *S. bombifrons*, and 2 *B. cognatus*. The same night, at 3.04 mi N of Central Highway junction with Rte. 191, (ca. 2.5 mi N of Elfrida), we observed about 300-500 each of breeding *S. multiplicatus* and *S. bombifrons* in a large runoff tank on the east roadside, along with a single *S. couchii* found on land: travelling N from this site, the night was dominated by small aggregations of breeding *S. couchii* with only a few *S. multiplicatus* for 5 mi, where *S. bombifrons assumed prime abundance and the other two species were much less common.* We also found a substantial breeding area, as shown by numerous LOR individuals of this species in the sacaton bottom on Rte. 186 at 1.0 mi N of Rte. 181 (junction to Chiricahua National Monument). This spadefoot is abundant across a spectrum of local environments, including lower woodland in Pinery Canyon.

Plains Leopard Frog--*Rana blairi*. 5 observations, 43 museum specimen records (+ 19 unidentified *Rana pipiens* complex specimen records). The plains leopard frog is in the Sulphur Springs Valley, over 300 km (about 200 mi) W of the nearest species population, found near the Rio Grande in south-central New Mexico. It was first identified in Arizona by Frost and Bagnara (1977) in 1974 and 1975. At that time, it occurred, as today, on the floor of the valley (along Dragoon Cutoff and south of McNeal), but also in and in association with lower montane stream systems at West Turkey Creek and Leslie Creek. That great expansion of species abundance appears to represent a short-term climatic maximum, during wetter years, at a time of great success of native ranid frogs in man-made waters, as seen in Colorado (Hammerson, 1982). Gradually, native ranids, including the plains leopard frog, in cattle ponds, fish ponds, and ornamental ponds were replaced by exotic species such as bullfrogs and centrarchid fishes that are more successful in deeper perennial waters.

In the early-mid 1990's, the plains leopard frog was found at the pecan orchard-row crop sump ponds 1.5 mi W of Rte. 191 (666) on Dragoon Cutoff, where it previously co-occurred with *R. chiricahuensis* and *Ambystoma tigrinum* (Frost and Bagnara, 1977; Clarkson and Rorabaugh, 1989). We found it in modest abundance at the Apache Electric Power Company (AEPCO) ash-settling ponds near Willcox Playa, where Clarkson and Rorabaugh first found them in 1986-7. Mosquitofish (*Gambusia affinis*) and tiger salamanders (*A. t.* cf. *mavortium*) are abundant over much of the wetland. This site is large, and has marshy ponds in various stages of recovery from initial creation and ash deposition, and it has an extensive marshy-boggy area between the ponds and Willcox Playa. It has a history of changing water chemistry that has probably significantly affected the aquatic vertebrate faunal patterns (for instance, Clarkson and Rorabaugh [1989] reported possible occurrence of bullfrogs at the site in 1986-7, but they were absent in 1993). The spatial and temporal heterogeneity of the site very probably help allow persistence of the plains leopard frog at a site with potentially harmful introduced species.

Other historic localities in the Elfrida-McNeal area (Clarkson and Rorabaugh, 1989) did not have leopard frogs in the 1990's, but David Parizek (personal communication) discovered a major population center at The Lakes (here called Kovacs Lakes) along Whitewater Draw 9.7 mi S and 1.5 mi W of Elfrida off Coffman Rd, and we located them 1.2 mi north of Kovacs Lakes in an agricultural sump-ephemeral marsh-Whitewater Draw wetland area. Kovacs Lakes may cover an area 1 km^2 or more at high water, as flooding Whitewater Draw spreads across the flat valley floor behind a complex of long levees; it may also go nearly dry, apparently constraining the population sizes of introduced yellow bullheads (*Ameiurus natalis*) and bullfrogs. All of the habitat areas currently occupied by this species in the Sulphur Springs Valley are strongly fluctuating in water level, or, at the power plant presumably in water quality. Creation of stable, deep, perennial waters at or near the current habitat would, we predict, lead to the extirpation of the plains leopard frogs by introduced species.

Chiricahua Leopard Frog--*Rana chiricahuensis*. 5 observations, 21 museum specimen records. An additional 19 records listed as *R. pipiens* may pertain to this species or to *R. blairi*. This species formerly occurred in many localities in the Sulphur Springs Valley (Frost and Bagnara, 1977; Clarkson and Rorabaugh, 1989), but the closest occurrences in 1993-5 were Leslie Creek, Pinery Canyon, and Cochise Stronghold. Localities formerly occupied on the valley floor either went dry after the wet period ending in the mid-1980's, or were occupied by exotic species that usually exclude the Chiricahua leopard frog. Arizona Game and Fish Department Nongame Branch (M. Sredl, J. Howland, personal communication) as well as Rosen et al. (1995 and *manuscript*) conducted wide-ranging surveys for this frog in the region during 1993-1994: its reappearance on the Sulphur Springs (or San Bernardino) Valley floor would represent a major recolonization event at substantial distance from source populations. Source populations are currently also severely depleted, and re-establishment would require (1) habitat renovation, especially removal of non-indigenous species, and (2) a series of wet years leading to widespread population expansions.

Bullfrog--*Rana catesbeiana*. 6 observations, 2 museum specimen records. This largest of North American frogs, native to the eastern US and Canada, is a voracious and stealthy predator, with tadpoles that are relatively unpalatable to fish. It occurs at perennial ponds and sparingly in associated lotic (flowing) waters. We have recorded it in the valley center in the Whitewater Draw drainage, and at only one other valley site at Sunsites (Rosen et al., 1995). It also occurs throughout the west Turkey Creek drainage basin wherever there is permanent water, including in ponds some miles out from the stream. Turkey Creek was a major leopard frog metapopulation site where Rancher Sanders introduced the bullfrog in the early 1980's, with subsequent rapid proliferation and spread of the bullfrog accompanied by total disappearance of leopard frogs by the 1990's (Josiah Austin, personal communication). Bullfrogs were

observed on Rte. 181 at 2 mi S and 0.8 mi N of Turkey Creek Road junction, the latter at Turkey Creek wash bed, on July 12, 1993. We have a museum record for Kansas Settlement at 11.6 mi S of Rte. 186 junction, in the 1970's and late 1980's, and we presume this population is still extant although we did not detect it. The bullfrog is not at saturation in the Chiricahua Mountains region, but it is still being intentionally spread and will have an increasing negative affect on native ranids.

Tiger Salamander--*Ambystoma tigrinum*. 7 observations, 0 museum specimen records.This species is apparently expanding its distribution in the Sulphur Springs Valley region. Greatest abundances were at Willcox sewage lagoons, AEPCO ponds southwest of Willcox Playa, and on Riggs Home Ranch northwest of Chiricahua National Monument. However, the species is far more widespread, as indicated by records of adults crossing roads during wet weather near Turkey Creek at 3.5 mi (rd) S of Chiricahua Monument junction on Aug. 19, 1975; on Rte. 191 (666) 0.8 mi N of Glenn Rd, at north end of Elfrida (1.3 mi N Central Highway) on July 18, 1993; on Leslie Canyon Road 0.77 mi S of Glenn Road on July 11, 1993; and on Rte. 186 SE of Willcox at 3.54 mi (rd) NW of Kansas Settlement Junction on July 31, 1993. We also observed it on Rte. 80 in the San Bernardino Valley at 5.97 mi (rd) NE of Tex Canyon Rd, on Aug. 22, 1994, and 1.5 mi N Price Cyn junction on July 18, 1995. Such an obvious abundance of this species could not have been overlooked prior to its regional appearance in the 1960's and 1970's, adding confirmation to the hypothesis that the entire Cochise County population originated through introduction and is thus non-indigenous. In Tom Ketchum Tank, Pedrogosa Mountains, we seined four large "cannibal morphs" of this species, a form not known in the indigenous subspecies (*A. t. stebbinsi*, from the San Raphael Valley), but common in the midwestern form *A. t. mavortium* (Collins, 1981; Collins et al., 1988).

Reptiles

Western Box Turtle--*Terrapene ornata*. 42 observations, 54 museum specimen records.Box turtles are seen in numbers in several areas of the Sulphur Springs Valley, which, together with the San Bernardino Valley, is the core area for the species in Arizona. During routine field work following the onset of good summer rains, it is common to see 2-3 box turtles every day, and the number could certainly be multiplied by even minimal directed effort. C.H. Lowe (personal communication) found them in far greater numbers, especially at the hills east of Pierce, prior to the occurrence of severe highway mortality in the 1960's-1980's. Willcox residents reportedly have an autumn box turtle race as part of the "Rex Allen Days" festivities, in which animals are brought to town, raced, and often later released.

Box turtles are especially abundant southeast of Willcox in the sandy, sand sagebrush (*Artemisia filifolia*) area at and east of the ancient beach dunes of Lake Cochise, and in the sacaton-mesquite sections southwest of Willcox. They seem to be uncommon or absent in the mesquite west of Willcox Playa, with our northern-most record along the west side of Willcox Playa being at Sunsites; it is of regular occurrence south of Sunsites, especially in the Whitewater Draw area and associated tobosa flats. We did not observe box turtles in the Chihuahuan desertscrub or in recently-utilized agricultural sections of the valley.

Yellow Mud Turtle--*Kinosternon flavescens*. 2 observations, 4 museum specimen records. C.H. Lowe "discovered" the southeast Arizona population of this species on April 25, 1952, at about 1 mi WSW of Elfrida. We have a museum record for 1974 around Whitewater Draw west of McNeal, and we received a live specimen from Rte. 191 (666) in the valley in the mid 1980's. We made three concerted efforts to trap this turtle in the southern Sulphur Springs Valley. We "rediscovered" the species August 6, 1989, at a pond 200 m east of Whitewater Draw at 1.5 mi N of Bagby Road on Coffman Road. David Parizek (personal communication) trapped a second individual on Sept. 2, 1993, at a pecan farm sump

pond 6.5 mi W and 0.5 mi S of McNeal, near Davis and Frontier roads junction. There may be undiscovered population sites around McNeal, but these may be difficult of access during the summer rainy season when the turtles are most active. The reason for rarity of the yellow mud turtle in the Whitewater Draw area is entirely unknown. The distribution and ecology of this species are of prime conservation importance for the region.

We also "rediscovered" an old, vaguely stated locality from Julius Hurter in 1898, given as simply Graham County. On August 19, 1994, we found yellow mud turtles in thriving populations in the San Simon and Whitlock Valley areas at San Simon Creek at Fan Road, Martin Well, Chaney Place, Rabbit Farm, Whitlock Detention Dam, Park's Lake (pond west of playa), and at puddles between the sites in Whitlock Valley. Possibly, the lower level of disturbance in this area, compared to the Sulphur Springs Valley, may contribute to the remarkable abundance of this interesting beast.

Sonoran Mud Turtle--*Kinosternon sonoriense*. 1 observation, 2 museum specimen records. We found a single Sonoran mud turtle on Rte. 666 (191) 1.65 mi (rd) N of Rte. 80, on August 5, 1989, and we have museum records for 2 mi N of Douglas on Rte. 80 (1977) and for 5 mi S of McNeal on Rte. 666 (191), although we have not verified the species identity for the latter record. The presence of this turtle as a rare species in the lower valley is consistent with the quasi-perennial, or formerly perennial, nature of Whitewater Draw. The yellow mud turtle should be more strongly represented 4 or more miles above the border, where better-developed summer ponds are present.

Madrean Alligator Lizard--*Gerrhonotus (Elgaria) kingii*. No observations, 1 museum specimen record. Present in the San Bernardino Valley to below 3500', and in the mountains surrounding the Sulphur Springs Valley, we have but a single museum record, for Paul Spur, in the southwestern corner of the valley, presumably on or near a hill. We did not observe it in the valley, a puzzling rarity. Perhaps the very heavy grazing, or long history of naturally persistent floodwaters, along Whitewater Draw has damaged ground cover so severely that the species has been extirpated. It will probably be found on upper bajada or lower canyon or rock slope habitats in the valley area.

Western Banded Gecko--*Coleonyx variegatus*. 1 observation, 9 museum specimen records. We have a single observation at 5.95 mi (rd) SE Kansas Settlement junction on Rte. 186 on Aug. 23, 1994, in high Chihuahuan desertscrub at the interface of upper bajada and rock slope. We also have a 1952 museum record for 2 mi SE of Dos Cabezas, and it has been seen at Portal, suggesting it may appear elsewhere on uppermost bajadas in the Sulphur Springs Valley area. We also have a somewhat more questionable 1959 museum record for 2 mi N of Willcox, although we would not expect it in these grasslands.

*Gila Monster--*Heloderma suspectum*. 2 observations, 1 museum specimen record. We observed this species once high on the bajada southwest of Castle Dome in the Pedrogosa Mountain area in 1995, and once just east of Douglas near Geronimo Trail in 1989. Records for Granite Gap (Peloncillo Mountains; Lowe, 1955), near Rodeo, and an observation in Mule Gulch suggest it may appear on the upper bajadas somewhere in the Sulphur Springs Valley. We have an older museum record (1933) for "near Gleeson, Sulphur Springs Valley", that is probably acceptable.

Lesser Earless Lizard--*Holbrookia maculata*. 9 observations, 77 museum specimen records. Primarily a grassland lizard, this appears to be one of four widespread, abundant, and prominent lizards in the Sulphur Springs Valley. It is a ground-runner in the open spaces between grass and shrubs, often found in larger patches of open ground in normally vegetated sites. It is in grassland and mesquite shrub,

but we have not seen it in Chihuahuan desertscrub, although it occurs in mixed tobosa-acacia-mesquite environments transitional to desertscrub. In this local area, it appears to be most abundant on the valley floor. There are reputed to be two species of lesser earless lizards present in the region, but in the absence of formal published descriptions and designation of populations, we have referred to all lesser earless lizards by historically accepted name.

Greater Earless Lizard--*Cophosaurus texanus*. 1 observation, 73 museum specimen records. Not generally common in the lowlands of Cochise County, this is a desert and semi-desert species that is found around the base of the mountains in southern Arizona. It was not seen on the valley floors of our study region in the 1990's, but single individuals were found in high Chihuahuan desertscrub on Davis Road 21 mi W of Rte. 191, between the Dragoon and Mule Mountains, and near Silver Creek 1 mi W of Portal. We have museum records for the upper bajada of the Dos Cabezas Mountains southeast of Willcox, and for the divide between Sulphur Springs and San Simon Valley, at Rte. 191. The species appeared to be moderately uncommon in high Chihuahuan desertscrub in the region, but R. Zweifel (personal communication) found it abundant in the lower oak woodland at Paradise.

Common Collared Lizard--*Crotaphytus collaris*. 1 observation, 6 museum specimen records. Lizard-eating (carnivorous) reptiles like this one, also insectivorous, are not prominent in the valley. We have one observation only, at the head of the Leslie Creek drainage basin, on uppermost bajada at 5050' elevation. However, there are museum records for 5 mi E of Bonita (Pinaleño bajada), near Portal and Dos Cabezas, and we saw it on the upper bajada at Horseshoe Canyon on the east side of the Chiricahua Mountains. It is presumably on the rocky hills that are widely scattered in the Sulphur Springs Valley, and on the upper bajada of the Dos Cabezas Mountains.

Long-nosed Leopard Lizard--*Gambelia wislizenii*. 2 observations, 22 museum specimen records. This is another large, powerful lizard and insect-eating lizard, which was formerly in the same genus as the collared lizard. It occurs in tobosa grass habitat on the Sulphur Springs Valley floor, but does not appear to be anywhere common. We have only two records, both within 4 mi S and SW of McNeal, and there are a substantial number of museum records for the area east and northeast of Willcox Playa, in alkali sacaton-dominated habitat, and at 10 mi SSE of Bonita in the northern valley.

Texas Horned Lizard--*Phrynosoma cornutum*. 13 observations, 59 museum specimen records. This species and the Mojave rattlesnake are the sole members of two large and diverse genera found on the Sulphur Springs Valley floor. Further, both are extremely abundant and frequently seen. The Texas horned lizard, however, is also found on high Chihuahuan desertscrub; like the Mojave rattlesnake, which is replaced by the western diamondback at lower elevations in Chihuahuan desertscrub (as at San Bernardino Ranch and lower Babacomari), the Texas horned lizard gives way to the regal horned lizard at the lower grassland-Chihuahuan desertscrub transition (as at San Bernardino Ranch and at Whetstone village. As with the rattlesnakes, the Sulphur Springs Valley is a showcase for this habitat partitioning that is far less clearly observed along Rte. 80 in the San Bernardino Valley.

Short-horned Lizard--*Phrynosoma douglassii*. 1 observation, 9 museum specimen records. We observed this typically montane, viviparous horned lizard only once in valley area grassland habitat, at the head of Leslie Creek basin, 4 mi S and 1 mi E of Rucker School. It occurs in modest abundance in the San Bernardino Valley grassland just south of Tex Canyon Road, and we have a museum and literature record (Mitchell, 1975) from the lower slope of the Dos Cabezas Mountains southeast of Willcox, in desertscrub habitat. This species could appear in the valley proper.

Round-tailed Horned Lizard--*Phrynosoma modestum.* No observations, 16 museum specimen records. We did not observe this species in the Sulphur Springs Valley, but have museum records for the upper bajada of the Dos Cabezas Mountains along Rte. 186. Nickerson and Mays (1969) reported it in abundance on the east side of the Pinaleños.

Regal Horned Lizard--*Phrynosoma solare.* 2 observations, 7 museum specimen records. We have recorded this species only in the lower valley near Douglas, on the Pirtleville Road and Geronimo Trail. It may not occur north of these areas in the grasslands or associated slopes. In the thornscrub or semidesert grassland along Geronimo Trail, it is nearly as abundant as the Texas horned lizard, although neither is seen frequently.

Clark's Spiny Lizard--*Sceloporus clarkii.* 3 observations, 13 museum specimen records. This is a medium-sized to large climbing lizard that is often an abundant riparian species, and is a widespread saxicolous, and also arboreal, species in the Arizona Upland desertscrub. It is abundant at lower montane elevations in the study region, and is found sparingly in the Sulphur Springs Valley on rocky hills. We have records for it only at Taylor Buttes, southeast of McNeal, at the rocky hills on Davis Road 12 mi W of Rte. 191, and museum records for the upper bajada of the Dos Cabezas Mountains, southeast of Willcox.

Desert Spiny Lizard--*Sceloporus magister.* 3 observations, 1 museum specimen record. A desert species, this large spiny lizard is uncommon in eastern Cochise County. We have recorded it only at three sites on the west and northwest fringes of Willcox Playa in mesquite- and burroweed-dominated former grassland habitat, and at two sites near Hot Well Dunes, in desertscrub.

Eastern Fence Lizard--*Sceloporus undulatus.* 25 observations, 70 museum specimen records. In our area, the occurring subspecies is the Southern Prairie Lizard *S. u. consobrinus.* This small-medium sized *Sceloporus* is perhaps the second most abundant and frequently seen lizard in the Sulphur Springs Valley, where it lives on the ground around dense grass or shrub, on shrubs, and on and around, or under, human-made debris of all kinds, but especially at corals and old house ruins.

Tree Lizard--*Urosaurus ornatus.* 18 observations, 168 museum specimen records. This widespread and abundant, arboreal and saxicolous lizard is among the three most frequently observed lizards in the Sulphur Springs Valley, despite the scarcity of trees, shrubs, or rocks in most areas. It lives on fence posts, corrals, and walls and buildings, especially old or ruined ones, and it is found on rocks and boulders at hilly sites. Without human influence it would probably be much less widely distributed in the area.

Side-blotched Lizard--*Uta stansburiana.* 1 observation, 3 museum specimen records. We have not seen this species on the Sulphur Springs Valley floor, but it probably occurs in the surrounding Chihuahuan desertscrub. The closest localities we have are 1 mi SW of Castle Dome, Pedrogosa Mountains, on the divide between the Sulphur Springs and San Bernardino Valleys, and at Hot Well Dunes, Whitlock Valley. Both localities are in desertscrub.

Great Plains Skink--*Eumeces obsoletus.* 1 observation, 4 museum specimen records. This large attractive skink is abundant in riparian and yucca-dominated areas of the San Bernardino Valley grasslands. We observed it only at Leslie Canyon. Its virtual absence in the Sulphur Springs Valley is apparently real, and like that of the alligator lizard, might possibly relate to mechanical damage to ground

cover by heavy grazing.

Little Striped Whiptail--*Cnemidophorus inornatus*. 5 observations, 402 museum specimen records. This lizard species was described by Van Denburgh (1896) as *Cnemidophorus arizonae* based on a specimen collected by Price in 1894 at Fairbank on the San Pedro River. The taxon vanished until rediscovered by Wright and Lowe (1965) based on specimens from close to Willcox, and was resurrected as *C. i. arizonae* by Wright and Lowe (1993). It was then, and remains, restricted to the vicinity of Willcox, as described below, and as a rare species in a local area on Hackberry Ranch, Whitlock Valley in southern Graham County (the latter population has not been revisited or reconfirmed for about two decades). This nicely-colored whiptail is an example of a grassland faunal element that, like the massasauga, apparently underwent a massive range reduction during and after the terrific overgrazing that plagued the region around and before the turn of the century (see Hastings and Turner, 1965; Bahre, 1991).

In the mid-1980's, Schwalbe and Lowe revisited the old, main collecting localities of Lowe, Wright, Bezy, Goldberg, Hulse, Mitchell, and others, at and near Willcox, from which huge numbers of lizards have been removed to museum collections. They found an overwhelming predominance (over 10 to 1) of *C. uniparens* over *C. inornatus*, and it appeared that the latter might go extinct in southern Arizona. Remarkably, in 1993 (August 1) we found a great preponderance of *C. inornatus* at the west edge of Willcox (18 to 4 *C. uniparens*), and at 2.64 mi W of the W city limits (8 to 2 *C. uniparens*). On August 2, 1993, we observed 3 *C. inornatus* in alkali flats 2-3 mi SE of Willcox. At Cochise and Croton Springs, 5-6 mi SW of the W-most *C. inornatus*, we found many *C. uniparens*, and at 0.92 mi S of Rte. 186 along Kansas Settlement Road (3 mi SE of the SE-most *C. inornatus*) we found only 7 *C. uniparens* on August 2, 1993. We did not observe them north of Willcox, but made few efforts to duplicate the single museum locality, 8.9 mi (rd) N of Willcox on Fort Grant Rd; and we have not visited the Hackberry Ranch site. Nonetheless, it seems clear that the core distribution of the little striped whiptail population in southern Arizona has remained practically unchanged since at least the early 1960's, following the apparent catastrophic contraction around the turn of the century. However, since the core of the distribution is at and near the growing town of Willcox, we have serious concerns about conservation of this hardy, attractive, endemic little reptile.

"Sonoran Spotted" Whiptail--*Cnemidophorus sonorae* sensu lato. 1 observation, 27 museum specimen records. This is actually an undescribed species that is widespread in southeastern Arizona on rolling terrain, often in open encinal grassland. At Buenos Aires National Wildlife Refuge, it occurs in rolling grassland and mesquite with *C. uniparens*, but we have seen it in grass or semi-desert environments in the study area only at and north of Leslie Canyon; it is primarily in mountain canyons. Mitchell (1979) reported it on the upper bajada of the Dos Cabezas Mountains southeast of Willcox. True *C. sonorae* (Lowe and Wright, 1964) are only known from near the Catalina Mountains in Pima County (Densmore et al, 1989; J. Wright, personal communication), and other undescribed species similar to these two are in southeastern Arizona (J. Wright, personal communication; Dessaur and Cole, 1989).

Western Whiptail--*Cnemidophorus tigris*. No observations, 13 museum specimen records. Our nearest observation for this desert species is at Hot Well Dunes in sandy desertscrub habitat, but Mitchell (1979) reported it on the bajada of the Dos Cabezas Mountains southeast of Willcox. We have a museum record for 10 mi SSE of Bonita in the northern valley area, at 4600 ft (1402 m) elevation. The species is neither characteristic nor common in the Sulphur Springs Valley.

Desert Grassland Whiptail--*Cnemidophorus uniparens*. 17 observations, 309 museum specimen

records. This unisexual (all-female, parthenogenetic) lizard is ubiquitous in the Sulphur Springs Valley, and is the most conspicuous reptile in most areas of the valley floor and on most of the bajadas. It is the only whiptail present over virtually the entire area. It is especially abundant in mesquite grassland, but is also found in abundance in tobosa and other open grasslands.

Glossy Snake--*Arizona elegans*. 1 observation, 5 museum specimen records. This snake is uncommon in the Sulphur Springs Valley and generally not common in Cochise County in the 1990's. We found a single individual in the Sulphur Springs Valley on May 29, 1995 on Rte. 191 (666) 2.5 mi S of Dragoon Cutoff, in an area with fallow row-crop fields, and have a second museum locality for the same general area. There are also single museum records for Rte. 666 (191) 3.0 mi (rd) N of Rte. 181 junction, near Turkey Creek Ridge, and for 4 mi (rd) N of Double Adobe.

Ringneck Snake--*Diadophis punctatus*. 1 observation, 4 museum specimen records. A single record of this attractive species was obtained on Rte. 80, at 2.13 mi (rd) W of Elfrida Cutoff junction on July 29, 1993, in rocky upper bajada within Mule Gulch in the Mule Mountains. There is a museum record for Trail Dust Zoo, along Elfrida Cutoff; museum records for the valley at Fort Grant probably pertain to montane records for the Pinaleños, and we have a single museum record for Leslie Canyon. Undoubtedly, this species will occasionally appear in the valley, but it's rarity nonetheless recalls the virtual absences of alligator lizards and Great Plains skinks; all three occur in montane environments as well as in grassland and riparian habitat over a wide area of the San Bernardino, but not Sulphur Springs, valleys.

Green Rat Snake--*Elaphe (Senticolis) triaspis*. 1 observation, 0 museum specimen records. This species is recorded from the Fort Bowie area by Lowe and Johnson (1976) in arid riparian environments, although they were unable to obtain a specimen. We observed it at a second riparian locality closely associated with the Sulphur Springs Valley in 1994. The species is known to enter, if not inhabit, grassland environments at distance from canyons where it is usually seen (D. Parizek, personal communication), so we expect its occasional presence in the Sulphur Springs Valley.

Chihuahuan Hook-nosed Snake--*Gyalopion canum*. No observations, 2 museum specimen record. This Chihuahuan Desert species is infrequently observed in Arizona, but may occur in desert grassland or semi-desert habitats (Lowe, 1964). We have a museum record for the species from the bajada below Chiricahua National Monument, on Rte. 181 1.8 mi S of Chiricahua Monument junction, in a grassland, mesquite, and shrub-dominated area, and another collected by Duellman (1955) from three miles W of Chiricahua Monument headquarters, quite close by. Why this species is so elusive in Arizona is unclear as yet, but at least until the reason is found it must be considered one of the rarest and most sensitive species of reptile in the state.

Western Hognose Snake--*Heterodon nasicus*. 15 observations, 46 museum specimen records. We found road-killed (Dead On Road) hognose snakes throughout the Sulphur Springs Valley floor, but not high on bajadas, from north of Willcox to the southern valley. Despite some efforts, we never found a live one, and others have had similar experiences (G. Bradley, personal communication). We attribute this to primarily diurnal activity by this thermophilic species (Platt, 1969), leading to basking on the road and high ensuing road mortality. The large number of animals we collected DOR indicates that the Sulphur Springs Valley is probably the ecological metropolis for this species in Arizona, as might be expected for a toad- and frog-eating snake.

Elsewhere in Arizona, this is also a grassland species in lowlands with many anurans, as at Elgin and

in the San Bernardino Valley. However, it would appear that hognose snakes are underground or highly sedentary almost all the time, except when travelling to feed during the primary bursts of anuran breeding early in the summer rains. Then, they are to be found in the neighborhood of breeding ponds and pools in habitat that may be rich grassland, agriculturally disturbed land, lovegrass, mesquite-shrub, or mesquite thicket. Their valley floor distribution may reflect primarily the historic concentration of anuran breeding aggregations there. Conservation of the hognose snake, therefore, will probably be primarily an exercise in anuran conservation.

Night Snake--*Hypsiglena torquata*. 7 observations, 6 museum specimen records. This small primarily nocturnal snake was uncommon in the valley. It is a habitat generalist in Arizona, and is probably somewhat more abundant on the upper bajadas and lower rock slopes than on the valley floor. We have only six observations of this common, widely distributed snake for the valley, including four on or near upper bajadas, and none in any core grassland areas.

Common King Snake--*Lampropeltis getula*. 32 observations, 39 museum specimen records. This species is at its ecological metropolis for Arizona in the valley, and vies with the Mojave rattlesnake for most frequently observed snake in the Sulphur Springs Valley. It is remarkably abundant in the tobosa grassland habitats in the southern valley, where it clearly dominates the snake fauna--in abundance and quite possibly as a snake predator. Here, it is seen as typically speckled-saddled *L. g. splendida*, inaptly named the "desert" kingsnake. We will use the name "desert grassland kingsnake" henceforth. In the northwestern part of the valley, west of Willcox Playa, individuals appear intermediate between this form and the white- or cream-banded "California" or Yuma king snake (*L. g. californiae* or *yumensis*): this transition, however, is unusually extensive, with adults showing strong intermediacy present through Tucson. In the Sulphur Springs Valley, the snake is in grassland and mesquite, including in heavily overgrazed habitat, but was not observed in agriculturally disturbed areas.

Sonoran Whipsnake--*Masticophis bilineatus*. 5 observations, 19 museum specimen records. The observation we have for this species in the Sulphur Springs Valley is at Mule Gulch bridge on Rte. 80 at High Lonesome Rd, September 2, 1994, in mesquite-whitethorn acacia-desert willow (*Chilopsis linearis*) surrounded by ocotillo (*Fouquieria splendens*) dominated scrub on rolling terrain. We also have a museum record for the bajada-rockpile junction southeast of Willcox, at the Dos Cabezas Mountains, and one for Rte. 80 at 4 mi NE of Douglas, also in a bajada situation. This species is abundant in montane riparian areas in the region, where we have also seen it at Leslie Creek and on Rte. 80 in the Mule Mountains at and north of Bisbee.

Coachwhip--*Masticophis flagellum*. 21 observations, 31 museum specimen records. This is a widespread and frequently seen snake in virtually all habitats in the valley, including agricultural edge, semi-rural, lovegrass, and mesquite grassland. We have only four observations in tobosa or alkali sacaton, suggesting that it, like the gopher snake, is uncommon in that habitat type in the valley. It was not observed in high Chihuahuan desertscrub, but probably occurs there in abundance. The valley population seems to be a mixture of three subspecies, rather than a clear representative of any one of them.

Gopher Snake (Bullsnake)--*Pituophis melanoleucus*. 57 observations, 68 museum specimen records. This is an abundant species in virtually all terrestrial habitats in the region, including agricultural margins, lovegrass-shrub and mesquite thicket (in both of which it is especially abundant or robust), mesquite grasslands, Chihuahuan desertscrub, and middle elevation montane canyons. Montane individuals in southeastern Arizona often have prominent head bands resembling those of the black-tailed rattlesnake

(*Crotalus molossus*). In the core of the tobosa grass environment in the southern Sulphur Springs Valley, we observed only two individuals at the north edge of the big grass patch, and only three in it, and just a single individual in the alkali sacaton near Willcox. This suggests (surprisingly, considering its broad geographic and ecological abundance and frequent association with grasslands) that it is not common in native grassland habitats on the valley floor.

Long-nosed Snake--*Rhinocheilus lecontei*. 20 observations, 45 museum specimen records. This is the second most abundant "desert" snake in the valley. It occurs in tobosa (uncommonly), other grassland types, is most abundant in mesquite-shrub habitats, and is less common in agricultural edges and in high Chihuahuan desertscrub. Those observed were a bright red morph that is similar to the subspecies *R. l. tesselatus*.

Graham Patch-nosed Snake--*Salvadora grahamiae*. 1 observation, 1 museum specimen record. This primarily is a montane species, abundant in the region, that could appear uncommonly in the bajada habitats normally frequented by the Western Patch-nosed Snake *Salvadora hexalepis*. We have one observation and a single museum record for this species in the grasslands west of Chiricahua National Monument and Swisshelm Mountains, but we have not been able to completely verify either record. This Madrean montane species is known from this habitat type elsewhere in southern Arizona, and since it is in the Chiricahua Mountains it probably does indeed occur in the valley.

Western Patch-nosed Snake--*Salvadora hexalepis*. 7 observations, 29 museum specimen records. This is an important species in high Chihuahuan desertscrub in southeastern Arizona, but we observed it in the valley only twice. We also have two museum and two additional verified sight records. All these observations are for high on the bajada below the Chiricahua and Swisshelm Mountains, in desertscrub and mixed grassland-subshrub habitat. Remarkably, we have no records for the middle or lower bajada or valley floor for this species--a habitat generalist in the Sonoran Desert.

Ground Snake--*Sonora semiannulata*. 1 observation, 11 museum specimen records. This species, known as a habitat generalist, in southern Arizona is most often seen in grassland, degraded desert grassland, and encinal (oak) grassland habitats. It is highly localized in southern Arizona, and is probably rare or uncommon except in a few grassland or oak grassland localities. In southern Arizona, and elsewhere in Arizona except for the Phoenix basin, local demes of this highly polymorphic species are usually monomorphic, and many (if not most or all) demes appear to be unique in details of the coloration of the single color morphotype present. On bajadas, north of Elgin in the Sonoita Grasslands and at the Tex Canyon-Rte. 80 junction, there are substantial demes with red and black cross-banding. The three specimens we have examined from the Sulphur Springs Valley floor, in contrast, are brown or ebony with a single reddish-purple narrower or wider mid-dorsal stripe, as also seen in the low-lying flats on fine soils between Marana and Eloy in central Arizona and in the relictual tobosa grasslands near Ventana Cave and Tracy's Trading Post (San Simon).

We found only a single individual during the relatively dry years of our study, under a rock in a diverse grassland dominated by tobosa, between Taylor Buttes and McNeal, near where two of our museum records originated. It is also known from the vicinity of Dos Cabezas (4 museum localities), the region of the divide between Aravaipa and Willcox playa drainage (1 museum record), and near the divide between the Sulphur Springs and San Simon valleys at Rte. 191 (1 museum record). Despite its poor showing during the relatively dry years of our work, it appears to be a grassland component of the regional herpetofauna.

Southwestern Black-headed Snake--*Tantilla hobartsmithi*. We have one museum specimen record for this species in the Sulphur Springs Valley, at 2.3 mi W of Willcox, a general area that also supports the desert spiny lizard *Sceloporus magister*, another characteristically Sonoran species. All other records of this genus in the valley are for the similar plains species; however, since we have not yet examined the specimens, their remains some doubt about the specific identities and their relative abundance. Despite some special efforts, we did not find black-headed snakes in the valley in the 1990's. The nearest localities we know of for the southwestern black-headed snake are at the west side of the Dragoon Mountains, and at San Bernardino National Wildlife Refuge. Other collectors may have raided cover sites in the moist spring of 1993, before we had the opportunity to search for the species, but in general it seems to be uncommon in much of the region.

Plains Black-headed Snake--*Tantilla nigriceps*. No observations, 11 museum specimen records. Museum records (n = 6) verify the occurrence of this species in the north-central valley from Willcox to near Kansas Settlement), and the northern valley (n=1) at 5 mi E of Bonita, but not at or south of Elfrida, suggesting it may have a local distribution like that of the plains spadefoot. It was uncommon or rare and we did not find it during the early 1990's.

Black-necked Garter Snake--*Thamnophis cyrtopsis*. 20 observations, 6 museum specimen records. This is a canyon-dwelling species in Arizona that is also occasionally seen on valley floors, as in the San Bernardino Valley south of Apache. It is abundant at Leslie Canyon, Swisshelm Mountains. We have seen it at several localities from several upper bajada areas from Dos Cabezas south across the grassy scrub below Chiricahua Monument and Turkey Creek (where it is also extremely abundant in montane riparian habitat), south along both sides and the length of the Swisshelms, and on the south end of the Pedrogosa Mountains. Along with the consistent observations in San Bernardino grassland at Apache (over many years), our records suggest a massive metapopulation complex, centered on the Chiricahua Mountains, expanded around its margins into Chihuahuan desertscrub and high grassland that we might expect to see occupied by the checkered garter snake.

Checkered Garter Snake--*Thamnophis marcianus*. 42 observations, 36 museum specimen records. This is the only garter snake recorded for the Sulphur Springs Valley floor, where it is abundant at most (probably all) sites with breeding populations of anurans. We found it especially abundant in Elfrida, at and north of Kovacs Lakes, and widespread at more moderate abundances in other habitat types. There are many museum records for the Kansas Settlement Road area. It is a dominant species on the valley floor, but absent or rare on bajadas, and with little overlap with the black-necked garter snake (none observed) along the slope gradient or in habitat categories. Along with the hognose snake, it is highly restricted to valley floor habitat in the Sulphur Springs Valley.

Lyre Snake--*Trimorphodon biscutatus*. 1 observation, 11 museum specimen records. Most frequently a rock-associated, lizard and mammal-eating snake, individuals in Cochise County and elsewhere in Arizona are sometimes found in Chihuahuan desertscrub many miles from rocks, boulders or outcrops. We have recorded it at Leslie Canyon, making it part of the valley herpetofauna, and it probably occurs more widely on hills within the valley, and in high desert and desert grassland at least occasionally, as noted by Lowe et al. (1986), and we have a museum record for 8 mi E of Bisbee, on Rte. 80.

Texas Blind Snake--*Leptotyphlops dulcis*. No observations, 3 museum specimen records. We did not observe this species during our study, but have seen it in the San Bernardino Valley and have museum

records for Douglas (in town) and for the Sulphur Springs Valley north of Douglas (no further locality information available).

*Western Coral Snake--*Micruroides euryxanthus*. 2 observations, 6 museum specimen records. We found this species twice, on the uppermost bajada and lower mountain slopes of Rte. 186 northwest of Dos Cabezas, whence earlier museum records also place it. These records are for mixed mesquite grassland-Chihuahuan desertscrub of high plant diversity on rocky-gravelly soils. Nickerson and Mays (1969) reported a coral snake from Fort Grant at 4750'. The species is probably very rare on the valley floor and most of the bajada, although we have two reliable reports of it found on roads in the Elfrida-Mcneal area.

*Western Diamondback Rattlesnake--*Crotalus atrox*. 32 observations, 16 museum specimen records. Remarkably, this species was not seen on the floor of the Sulphur Springs Valley during 1993-1995. We have two museum locality records from the west and northwest of Willcox Playa, an area that also has a record of the Sonoran desert toad, as well as desert spiny lizards and glossy snakes. Various desert species may penetrate the valley floor there along with dense mesquite, at similar elevations to those elsewhere supporting the Sulphur Springs Valley grassland herpetofaunal assemblage, as a result of proximity to the Dragoon Mountain bajada and lower rock slopes.

We also found the diamondback in abundance high on the bajada: we found it north of Davis Road (at 12.4 mi W of Rte. 191) on the west valley margin, and repeatedly on Davis Road and Leslie Canyon Road in Chihuahuan desertscrub, as well as on Leslie Canyon road at the lowermost edge of Chihuahuan desertscrub, and at Leslie Canyon. It was prominent in the mesquite-shrub-yucca grassland bajada north and northwest of the Dragoon Mountains on Dragoon Road, and was fairly abundant on the bajada and lower rocky slopes of the Dos Cabezas Mountains, as well as on the divide between the Sulphur Springs and San Simon valleys, in high Chihuahuan desertscrub and shrubby grassland. It was notably absent from tobosa and other grassland habitats during our study We have two sight records near the Turkey Creek Ridge-Sulphur Hills rocky complex in the center of the valley, of which one was from 1975 at 2.2 mi N of Rte. 666 on Kansas Settlement Rd. at over 1 mi. from the short rocky bajadas, in mesquite-shrub flats.

In general, there are many more records for this species from the 1970's and earlier from the valley, some in areas where we saw a number of Mojave rattlesnakes. There may have been a contraction of the local distribution of this species in the Sulphur Springs Valley, perhaps as part of a general expansion of valley rattlesnake abundance in an area strongly dominated by the Mojave rattler. The increased abundance has been described for the San Bernardino Valley (Mendelson and Jennings, 1992), but in that case the distribution of the Mojave rattlesnake appeared to contract relative to that of the western diamondback. Our observations suggest that the situation may have a complex dynamic, and may not be any direct response to grazing or shrub invasion, as suggested by Mendelson and Jennings (1992), or even any simple response to climate, as suggested by Rosen et al. (1996) and indirectly by Pough (1966).

*Black-tailed Rattlesnake--*Crotalus molossus*. 5 observations, 8 museum specimen records. This is a mountain or rock-dwelling species that is abundant in the Chiricahuas and Dos Cabezas, and at Leslie Canyon in the Swisshelms, whence it must at least occasionally enter the Sulphur Springs Valley. It is generally found at a broad range of elevations and in a variety of habitats in Arizona, including desertscrub. It could occur on rocky hills within the valley floor, but has not been recorded there yet.

*Mojave Rattlesnake--*Crotalus scutulatus*. 61 observations, 91 museum specimen records. This is the most abundantly collected snake in the Sulphur Springs Valley, where it is found in numbers in tobosa and other grassland, and mesquite-shrub, mesquite grassland, and mesquite thickets. It is probably

least abundant in the core tobosa habitat. In the Sonoran Desert, this species broadly overlaps the western diamondback in all aspects of spatial niche. However, we did not find the two in sympatry in the valley area at all, a situation also seen in other parts of southeastern Arizona. The partitioning in the Sulphur Springs Valley--with western diamondbacks observed only, and abundantly, in the high Chihuahuan desertscrub, and Mojaves abundant everywhere except for their essentially complete absence from the desertscrub--is the most distinctive observed in southern Arizona. Many individuals, especially from grassland, look like prairie rattlesnakes (*C. v. viridis)*, but all had key characters unmistakably identifying them as Mojaves.

*Massasauga--*Sistrurus catenatus*. No observations, 4 museum specimen records. This species currently is abundant in Arizona in only a short stretch of Rte. 80 in the San Bernardino Valley near Tex (Rucker) Canyon junction (personal communication, A. Holycross; personal observations), where we twice observed it during this study. It was originally known from the Fort Huachuca parade grounds and from near Palominas, areas from which it probably has been extirpated. We have located four museum vouchers for massasaugas in the Sulphur Springs Valley between 1950 and 1989, all between 4 and 14 mi N of Rte. 80 on Rte. 191 (666) in tobosa grass-dominated habitat. The localities seem to be in areas with slight relief, although they are all on the valley floor and lack rocks. We made a considerable and unsuccessful effort to find this species in the area on roads, under cover, and active in the habitat. There is a possible sight record for the old Willcox dump (C. May, personal communication) for the 1990's. The massasauga probably still occurs in the southern Sulphur Springs Valley, but it is either uncommon or extremely local. It is a species of great conservation concern in the valley.

Potential Species

We regard the following taxa to be of possible occurrence in the Sulphur Springs Valley including especially its upper bajadas and rocky hills. Not included here are high elevation forest species that would only enter the valley under abnormal circumstances, such as the twin-spotted rattlesnake *Crotalus pricei*, mountain spiny lizard *Sceloporus jarrovii*, and striped plateau lizard *S. virgatus*.

Canyon Treefrog--*Hyla arenicolor*. This species is moderately abundant in the Chiricahua Mountains and probably anywhere in the region with outcrops and boulders and semi-perennial water. There may be one or more populations in the valley, at the lower margin of waters that are perennial higher up.

Lowland Leopard Frog--*Rana yavapaiensis*. This species could enter the valley along Whitewater Draw, from the south, much as it apparently entered San Bernardino National Wildlife Refuge (Rosen and Schwalbe, 1996), and presumably occurs at least occasionally around the headwaters of Aravaipa Creek within the defined confines of the Sulphur Springs Valley. It is similar enough to the plains leopard frog that confirmation of its presence will require specimens or the presence of experienced observers.

Desert Tortoise--*Gopherus agassizii*. There is a record for a desert tortoise between Paradise and Bowie, and records on the east side of the Perilla Mountains, suggesting the possibility that indigenous tortoises may exist in the Sulphur Springs Valley. If so, they would be in relatively remote areas, such as the bajada surrounding the Dos Cabezas Mountains on the south and west.

Mountain Skink--*Eumeces callicephalus*. This typically Madrean species is in Guadalupe Canyon in riparian habitat within grassland, and although it is not currently known from the Chiricahua Mountains

(Lowe and Zweifel, 1992), we suspect its presence. If the latter is true, it may appear in the valley occasionally.

Zebra-tailed Lizard--*Callisaurus draconoides*. This is a Sonoran Desert species that may be absent from the Sulphur Springs Valley. Our closest record is at Hot Well Dunes, north of Bowie, in desertscrub on sand dunes.

Bunch-grass Lizard--*Sceloporus scalaris*. This is primarily a Madrean montane species that does, however, occur in sacaton and other grassland habitat in the Sonoita Grasslands around Elgin (e.g., Bock et al., 1990) and San Raphael Valley (personal observation), and could thus appear in the Sulphur Springs Valley.

Canyon Spotted Whiptail--*Cnemidophorus burti*. Museum records for this attractive giant whiptail lizard were confirmed in 1993-5 for Guadalupe Canyon, Peloncillo Mountains, and Hooker's Hot Springs (Muleshoe Ranch, Winchester Mountains), and we have an additional locality on the NE face of the Pinaleño Mountains (Ash Creek), so the species might be found occasionally in the northern section of the Sulphur Springs Valley proper.

Chihuahuan Spotted Whiptail--*Cnemidophorus exanguis*. This all-female lizard species is abundant at moderately high elevations in the Chiricahua Mountains, but might nonetheless appear occasionally high on the bajada in the Sulphur Springs Valley.

"Sonoran Spotted" Whiptails--*Cnemidophorus* sp. (*sonorae* sensu lato). One or more additional undescribed unisexual species (clones with independent origins involving hybridization of *C. inornatus* and *C. burti*) occur in the Chiricahua Mountains (Dessaur and Cole, 1989; J. Wright, personal communication), and could appear in the valley.

Sonoran Mountain Kingsnake--*Lampropeltis pyromelana*. This Madrean woodland species is well known in the Chiricahua and other regional mountain ranges, and may descend into Leslie Canyon.

Milk Snake--*Lampropeltis triangulum*. This species has recently been discovered in the San Bernardino Valley (Holycross and Schwalbe, 1995) in an area so heavily frequented by herpetologists over the years that we must admit the possibility that it has also been overlooked in the Sulphur Springs Valley, probably at or above 4600' elevation.

Yaqui Black-headed Snake--*Tantilla yaquia*. This is a Madrean species of moderate abundance low in the montane oak woodlands of southeastern Arizona, and probably is to be found in the grassland valleys in the long linear live oak and deciduous gallery forests extending substantial distances away from the mountains along most or all major drainages on the west side of the Chiricahuas. We observed it during 1993-5, however, only at Sulphur Draw (on the east side of the Chiricahuas) and at Papago Spring south of Elgin and Sonoita (Canelo Hills).

Mexican Garter Snake--*Thamnophis eques*. This species probably once occurred along Whitewater Draw near the international border, when more perennial water was present, and it could conceivably appear or reappear there, although we consider this unlikely.

Western Blind Snake--*Leptotyphlops humilis*. We have no records for this species in the region,

but it is probably present, at least under relatively desert-like conditions, and is to be expected in the Sulphur Springs Valley. We have also observed this species up to the oak woodland belt elsewhere in Arizona and Sonora.

Tiger Rattlesnake--*Crotalus tigris*. This species has recently been reported at and near Guadalupe Canyon, Peloncillo Mountains (Painter and Milensky, 1993; and personal observations), so it could occur in the Perilla or Pedrogosa Mountains and hence enter the valley.

Western Rattlesnake--*Crotalus viridis*. The Arizona black rattlesnake *C. v. cerberus* may descend to 3400' elevation, in chaparral, and lower into riparian corridors in desertscrub, and this subspecies occurs in the Pinaleño and Galiuro Mountains (Lowe et al., 1986; personal observations). It is unlikely, but possible, that it might appear in the grass-dominated habitat at the valley margin. The prairie rattlesnake *C. v. viridis* may occur at the New Mexico state line, and could conceivably appear on the Sulphur Springs Valley floor, but the lack of records to date makes this highly unlikely.

Structure of the Sulphur Springs Valley Herpetofauna

The Sonoran Desert herpetofauna at Organ Pipe Cactus National Monument is structured primarily by nearly one to one species replacements at the rock slope-bajada interface, with a limited valley floor-bajada faunal shift represented by Mojave-Sonoran reptile species replacements (Rosen and Lowe, 1996 *in press*). In southeastern Arizona, the situation is considerably more complex in several aspects. It is widely appreciated that Madrean woodlands have their own biota, and that there is stratification even within the wooded montane environment. Our work in the Sulphur Springs Valley, however, does not directly involve any Madrean woodland formations. We are studying a grassland-desertscrub-thornscrub (or dry tropic scrub) gradient and mosaic system.

The Sulphur Springs Valley has a well developed slope gradient. There are rock slopes supporting juniper-oak savannah, grassland, grassland-shrub, or desertscrub. Below the rock slope, the uppermost bajadas are less rocky and steep, but may support fairly similar vegetation, before giving way to core upper-middle bajadas that support either Chihuahuan desertscrub, plains grassland, or degraded grasslands with various levels of shrub development. These middle bajada environments give way to lower bajadas, still slope, but with much finer, heavier soils, that typically have more mesquite and burroweed, and often much grass.

Finally, and most characteristic of the Sulphur Springs Valley, is the broad level floor extending at distance from Whitewater Draw in the south and Willcox Playa in the north. This valley floor supports distinctive tobosa-dominated habitats, especially in the southern valley from McNeal to about 3 mi north of Douglas, usually with a strong representation of other important large perennial grasses. In the northern valley, at and southeast of Willcox, the grassland is dominated by alkali sacaton, and most areas are substantially invaded by scrub. The grasslands may be variously invaded by scattered, mostly short stature mesquite, burroweed, and soaptree yucca, or they may be degraded to mesquite-burroweed-grass scrub. In places, especially around the northwest, west, south, and east margins of Willcox Playa, this former grassland is now dominated by dense stands of tall stature mesquite, usually with burroweed and little grass in the still-grazed understory. In contrast, on the valley floor near Douglas, below the core tobosa patch, the mesquite is of medium stature, and grows with a diverse assemblage of yucca, agave, cactus, and other shrubs in an open thornscrub.

It is as a reflection, or possibly as a consequence, of this underlying complexity that the valley herpetofauna of the Sulphur Springs is structured. Here we develop a first outline for the structure of the assemblages of amphibians and reptiles, within the context of observable habitat areas; and we also begin to examine the substructure, the biogeographic origins, of the observed ecological structure. The expansive flats of the valley floor support the most unique grassland element of the herpetofauna (Category 1)--the plains leopard frog, plains spadefoot, yellow mud turtle, lesser earless lizard, Texas horned lizard, little striped whiptail, western hognose snake, checkered garter snake, probably the Texas blind snake, and the massasauga. These species are widespread on the valley floor--regardless of vegetation except where there is excessive mechanical disturbance to the ground surface, and they are unknown or are uncommon on bajadas in the Sulphur Springs Valley.

Other important grassland species (Category 2) are included on the valley floor and are also present and abundant on grassland, but not on desertscrub, bajadas; examples are Woodhouse toad, western box turtle, desert grassland whiptail, southern prairie lizard, plains black-headed snake, ground snake, desert grassland kingsnake, and Mojave rattlesnake. The massasauga is poorly known, and may fall into this category rather than the preceding, along with the lesser earless lizard. Several anurans--the green toad, Great Plains toad, and Couch's spadefoot may have been probably partially confined to the valley floor originally, but now appear to occupy all vegetation zones below the Madrean woodland.

The degree to which Categories (1) and (2) are distinct is not well defined at present. Further, some of the species in this category may also occur in greater degree than now known in high Chihuahuan desertscrub. The apparently rare Chihuahuan hook-nosed snake is an example of a grassland-associated species that is also well-known in Chihuahuan desertscrub (J. Howland, personal communication; personal observations). The lesser earless lizard and Texas horned lizard could also be found in this distributional pattern.

There is another grouping of species (Category 3) that occurs abundantly only in a narrow band in complex high Chihuahuan desertscrub astride the rock slope-bajada interface. These are mostly elevational generalists that are substratum specialists on rocks and primarily desert species restricted to this narrow portion of this gradient--greater earless lizard, round-tailed horned lizard, Clark's spiny lizard, common collared lizard, western patch-nosed snake, western coralsnake, and western diamondback. The Chihuahuan hook-nosed snake may behave, ecologically, in this fashion in our area, but is poorly known at present.

Category (4) is comprised of desert-centered species that are not as abundant as we might expect in the Sulphur Springs Valley. Certain species (Category 4A) are generalists with broad geographic and ecological distributions--such as the tree lizard, coachwhip, and gopher snake--that are abundant in most or all habitats with the exception of the grassland core, where they are surprisingly uncommon. Other desert species (Category 4B)--especially Sonoran Desert species--are uncommon and often localized in the Sulphur Springs Valley: Sonoran Desert toad, western banded gecko, Gila monster, side-blotched lizard, desert spiny lizard, leopard lizard, western whiptail, southwestern black-headed snake, night snake, and glossy snake.

Finally, Category (5) is comprised of regionally mountain-centered species that enter the valleys primarily from distributional centers in higher elevations and life zones. There are (Category 5A) Madrean montane species that are uncommonly or locally present high on the bajada, including the Madrean alligator lizard, short-horned lizard, Sonoran spotted whiptail, and mountain patch-nosed snake; other core Madrean species do not enter (or in some cases even approach) the grassland biome here. There is also

an assortment of primarily riparian species in this area (Category 5B) that penetrate the valley--at least fairly extensively, as in the black-necked garter snake and probably the lyre snake and Sonoran whipsnake, or only barely, as in the Great Plains skink, green rat snake, ringneck snake, and black-tailed rattlesnake--in areas near or associated with riparian habitat or riparian effects. These latter species are widely distributed within desert regions or in desert habitats elsewhere, but most or all of them have primary regional populations here in the Chiricahua Mountains, and in southeastern Arizona they represent an intermediate elevation riparian association, with the tiger rattlesnake where it occurs.

Finally (Category 6), there are the perennial water species that occur from medium and high elevations to the valley floor wherever suitable water occurs--Chiricahua leopard frog, bullfrog, and Sonoran mud turtle.

Thus, to restate and summarize, this complex herpetofauna of at least 61 species has at least six ecological categories (the categories are conceptual fragments of a multidimensional entity), and possibly eight or more. Biogeographically, this fauna has originated in at least four biomes: the plains (Kansan), desert (Sonoran and Chihuahuan), thornscrub (Sonoran), and woodland (Madrean). With the exception of primarily Great Plains species on the valley floor and Madrean species around the valley periphery, however, species abundances and habitat niche occupancy appear to be determined more individualistically, or at least without regard to biogeographic origin. Regionally desert-centered taxa may be rare (e.g., southwestern black-headed snake, night snake, glossy snake) or abundant (e.g., coachwhip, gopher snake), and usually not abundant in core grassland, but one desert species, the long-nosed snake, is abundant in many habitats including the core tobosa grassland. Understanding the ecological forces that bring about the remarkable structure of the herpetofauna remains an important and enticing challenge.

Conservation of the Sulphur Springs Valley Herpetofauna

From the standpoint of conservation of the most threatened sectors of the southern Arizona herpetofauna--and as reflected in the Sulphur Springs Valley--our greatest concerns are with the native aquatic and grassland assemblages. In the Sulphur Springs Valley today, the aquatic species of concern are also grassland associates, the plains leopard frog and yellow mud turtle. It is reasonable to focus entirely on the grassland component as a whole, and explore ways that its conservation in terrestrial, ephemeral water, and perennial water phases may be combined or approached independently.

The indigenous grassland herpetofauna [27 species] on the valley floor is dominated by anurans (spadefoot toads [3] and true toads [3], with the plains spadefoot and the green toad being of special interest) and reptiles. The primary snakes [6], in order of abundance in the grassland are the kingsnake, Mojave rattler, checkered garter snake, hognose snake, longnosed snake, and probably the ground snake. Snake species also present in modest numbers [5] are the gopher snake, coachwhip, and, in low numbers but of great interest, the plains black-headed snake and massasauga. The Texas blind snake may also occur, but it is difficult to observe and hence very poorly known. The terrestrial western box turtle is important in the grassland, may be declining, and is widely enjoyed by the public as an attractive species. The lizard species [7] of this grassland comprise the desert grassland whiptail, the locally endemic subspecies of the little striped whiptail, the lesser earless lizard, tree lizard, leopard lizard, southern prairie lizard and Texas horned lizard, which is thriving and plentiful in extreme southeastern Arizona and appears to be doing well elsewhere in its range (Donaldson et al., 1994).

Also present in the Sulphur Springs Valley, and deserving local and regional conservation attention,

are the rare Chihuahuan hook-nosed snake and the green rat snake. The species of greatest concern, in order of priority for attention, with primary or potential threats or problems in parentheses, are (1) plains leopard frog (introduced species, habitat modification and destruction), (2) little striped whiptail (urban or suburban and agricultural encroachment, extremely localized distribution, possibly succession away from grassland), (3) yellow mud turtle (habitat destruction, probable other unknown), (4) massasauga (unknown, possible effects of heavy grazing), (5) western box turtle (road mortality, possibility for commercial collection), (6) green rat snake (potential for over-collection), (7) western hognose snake (road mortality), (8) Chihuahuan hook-nosed snake (unexplained, apparent extreme rarity in Arizona), (9) ground snake (potential extinction of unique demes by collecting or trampling of surface cover by cattle), (10) plains black-headed snake (apparent rarity, possible trampling of microhabitat), (11) Texas horned lizard (at western range margin).

Some species of concern are widespread outside Arizona but should not be overlooked because they are morphologically distinctive: little striped whiptail (endemic subspecies at Willcox), ground snake (distinctive local demes), massasauga and western box turtle (desert grassland subspecies). Two more are also widespread but are highly disjunct in the Sulphur Springs Valley and will probably be found to be genetically distinctive: plains leopard frog, yellow mud turtle. From our Arizona standpoint, all 11 species listed above are important parts of the state's natural heritage that we will want to ensure in perpetuity, and all of them face real threats or are apparently quite rare for poorly understood reasons.

MANAGEMENT RECOMMENDATIONS FOR THE HERPETOFAUNA AT AND NEAR THE SULPHUR SPRINGS VALLEY

We present recommendations for management actions that might be taken on a species-by-species basis, with consideration of ecosystem conservation discussed within appropriate species. A synopsis of these recommendations is given in the Executive Summary.

(1) Plains leopard frog. The best viable population center is at lower-central Whitewater Draw centered on Kovacs Lakes, and with presumed metapopulation outliers known to only a few miles north at this time. The key to conservation of this species (Rosen, Schwalbe, and Sartorius, 1996) appears to be maintenance of highly fluctuating quasi-permanent water sources, and to the extent possible, elimination of artificially stable perennial waters in the area. This fluctuating regime is apparently the factor permitting co-existence of this frog with the diverse introduced fish and amphibian fauna that we cannot otherwise control or eliminate in the immediate future.

There is plausible concern that unfavorable management at Kovacs Lakes could lead to the loss of the population here, and that this could lead directly to species loss from the state. Kovacs Lakes could be a multi-species conservation area, possibly with recreation (e.g., picnicking, boating, bird-watching, but not fishing), under a careful management scheme. There would have to be a generous easement negotiation with the current landowners, or outright purchase of the area. Other ponds in the area, unlike Kovacs Lakes, were subject to highly unfavorable management during the mid-1990's from the standpoint of the plains leopard frog (draining, stocking with non-native fishes, use of wells to maintain constant water level).

There is a second population center for the plains leopard frog--at AEPCO plant and Dragoon Road pecan farm sump ponds. These habitats are inherently unstable--so much so that it is difficult to envision any realistic plan to assist the frogs there. Voluntary landholder cooperation, to the extent of communicating with Nongame Branch in attempts to not destroy the habitat, would be beneficial but probably requires motivation and effort not currently available. Our recommendation is thus for the Kovacs Lakes region of the southern valley.

Recommendations: **(1)** The plains leopard frog should be considered endangered in the state.

(2) ***Option 1.*** Offer easement options to landholders to minimize creation of highly stable, perennial pond environments, and to eliminate the translocation and restocking of non-native species (especially fishes, bullfrogs, and crayfish). First and foremost this effort should include the Kovacs Lakes property, and the next major parcel to the north, on Whitewater Draw, which is managed by Charlie Wilson. Secondarily, habitat management easement efforts should be made throughout the southern valley region, especially within five miles of Kovacs Lakes. ***Option 2.*** Acquire Kovacs Lakes and other available areas of Whitewater Draw as a conservation and recreation area. The area could perhaps be analyzed for potential for bird-watching, other nature observation, and hunting, as productivity is substantial; fishing should be discouraged, as that will lead to further difficulties with introduced aquatic species.

(2) Little striped whiptail. This subspecies is highly endemic, occurring at and near Willcox, and it is markedly disjunct from the nearest species populations in New Mexico and northwest Arizona. However, it is little recognized, and poorly understood ecologically. Thus, two recommendations.

Recommendations. **(1)** The Arizona whiptail, *Cnemidophorus inornatus arizonae* Wright and Lowe, should be listed as state threatened. Such listing would require that scientists fully justify any additional sampling on this already very heavily collected taxon. It will also draw attention to the population and perhaps assist in urban planning with consideration of open space and natural vegetation.

(2) As a listed taxon, additional information will be desired. First, we need an exhaustive study of

the distribution of the Arizona whiptail. Second, we need to establish simple, but reliable monitoring protocols, probably involving lizard line transects (e.g., Rosen and Lowe, 1996), which should be readily applicable in the occupied habitat. Third, we need to more fully understand the habitat utilization and requirements of this taxon, firstly, in relation to the sympatric desert grassland whiptail (which might have the potential for outcompeting the Arizona whiptail), and second, in the context of the species habitat utilization elsewhere in its range.

(3) Yellow mud turtle. The two populations, in central Whitewater Draw and in The Fan-Whitlock Valley, are disjunct from one another and from the nearest species populations in Sasabe-Tohono O'otam Reservation. They are the only Arizona representatives of the nominate subspecies, *Kinosternon flavescens flavescens*, which occurs as another outlier in the Animas Valley of New Mexico. We may wish to ensure the survival of these limited populations, and to enhance the one in the Sulphur Springs Valley, which is sparse and apparently not thriving. The Sulphur Springs population is largely co-extant with the best plains leopard frog metapopulation, which may deserve management. Thus, three recommendations.

Recommendations. (1) State listing as threatened, for the subspecies *K. f. flavescens* only. The listing level should ensure that scientists, or others, do not wantonly collect at the two southeastern Arizona sites, which were poorly known and unknown prior to this report. Some limited collecting is clearly sustainable in Graham County; very little should be done in Cochise County--at least until we can determine that, or manage the population or habitat such that, status is secure.

(2) Investigate the distribution and abundance of the Sulphur Springs Valley population in more depth. Bait-trapping, mark-recapture, radiotelemetry, and direct visual observation may be appropriate methodologies. The obvious starting point is an extensive trap survey, with measuring, marking, photographing, and release of captured turtles. Phylogenetic study using blood samples and morphometrics, both possible without sacrificing the animals, would also be relevant to the question of distinctiveness.

(3) Encourage habitat conservation through land purchase, as described for the plains leopard frog (1, above). This recommendation is made as a supplement to that one. The yellow mud turtle may thrive, in the short run, in stable perennial ponds, although they appeared to be most abundant in The Fan in ephemeral waters; further, the Sonoran mud turtle is presumably competitively superior in perennial waters (based on ecological distributions), and would thus eventually replace the yellow mud turtle under that wetland regime.

(4) Massasauga. The massasauga may be declining in the Sulphur Springs Valley, since we were unable to find any despite concentrating substantial efforts in the southern valley tobosa-dominated area where all four known museum records originated. It still is moderately abundant at a 4-8 mile reach of Rte. 80 in the San Bernardino Valley (A. Holycross, personal communication), but earlier records from near Rodeo and the Pedrogosa Mountains appear to represent recently lost (past 2-4 decades) population areas, following on the more extensive documented range contraction from the turn of the century. If the population is declining and the range is contracting, we do not known why. If so, furthermore, we will lose the species from the state. Three recommendations are therefore included here.

Recommendations. (1) Further survey by road-driving in lower Sulphur Springs Valley and in the Hereford-Palominas area.

(2) Research directed at identifying cause of decline for the massasauga.

(3) For the Sulphur Springs, consideration of purchase of parkland in remaining grassland habitat. This could support multiple grassland species (birds, mammals, plains leopard frog, green toad, yellow mud turtle, western box turtle, massasauga, Mexican hognose snake, ground snake, plains black-headed snake, desert kingsnake; possibly Yaqui River basin fishes), and could also be utilized for hunting. The area for this is between Davis Road (McNeal) and Glenn Road (4 miles north of Rte. 80), to the east of,

or including land on both sides of, Rte. 191 (666). Probably the most attractive holding is the EE Ranch (owned by a Mr. Eckoff), headquartered at 2.4 mi E and 1.2 mi S from the junction of Davis Road and Rte. 191.

This property has a great expanse of tobosa and other native perennial grasses, as well as transitional desertscrub, rocky buttes, and a number of good ponds and wells. It also contains the lower reaches of the Leslie Creek drainage, linking valley and canyon leopard frog populations, suggesting that one or both leopard frog species (plains, Chiricahua) might thrive there under reduced or regulated cattle access to ponds, and after removal of introduced fish. Finally, the property is proximal to Whitewater Draw, and could be encompassed within a unified lower valley conservation area.

(5) Western box turtle. Box turtles are subject to collection, export, and road mortality. However, the southeastern Arizona population appears to remain healthy. "Appears" is not an encouraging word, but we cannot raise an alarm. Arizona Game & Fish should maintain a file of records of box turtles based on AGFD personnel assigned to herpetology or to specific areas, or should establish transect routes for opportunistic monitoring. Box turtles should be retained on the Heritage list of Sensitive Species. The department should support and encourage intensive population study.

(6) Green rat snake. This snake is highly sought-after by collectors. The department should continue to evaluate and consider the need to protect it against collection and commercial exploitation. Behavioral and population studies should be encouraged.

(7) Western hognose snake. This species appears to suffer heavy road mortality. There is no immediate cause for alarm, but research on abundance and ecology should be supported. This appears to be an important species for anuran ecology in southeastern Arizona, as a predator. Sensitive Species status should be dependent upon its abundance in other areas than the Sulphur Springs Valley, where it appears to be thriving. It appears to extend no further west than Sonoita, Arizona.

(8) Chihuahuan hook-nosed snake. The rarity of this snake, and its ecology in Arizona and elsewhere, are so poorly understood that it should be considered a Sensitive Species, and further study is to be encouraged. If sight or collecting records do not accumulate over the next year or two, there could be cause for concern that the species is declining. We made special efforts to find it, in vain.

(9) Ground snake. From the Phoenix perspective, this is an abundant, exploitable, and perhaps even uninteresting species. In southern Arizona it is uncommon, patchy, and apparently has significant differentiation among demes. Studies of its ecology are to be encouraged, and the following recommendation should be considered.

Recommendation. The ground snake, *Sonoran semiannulata*, should be considered a Heritage Program Sensitive Species in southern Arizona (i.e., south of the Phoenix metropolitan area). The degree of discontinuity of its distribution should be evaluated statewide.

(10) Plains black-headed snake. The uncommonness we observed for this snake is probably more apparent than real, because we worked in relatively dry years, and because the state population appears to be fairly widespread--as shown by the range map in Conant and Collins (1991). Nonetheless, in the absence of positive data, the species should be retained on the list of Sensitive Species.

(11) Texas horned lizard. Based on its abundance and wide distribution in the Sulphur Springs Valley, and the frequency of sightings in the San Bernardino Valley, this species does not warrant Sensitive Species

listing in Arizona. Records should be maintained on it opportunistically, however, as it is at its western range limit in southeastern Arizona.

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